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ANSI/AFBMA
Std 9-1990
(Revision of
ANSI/AFBMA
Std. 9-1978)

AMERICAN NATIONAL STANDARD

AFBMA STANDARD

LOAD RATINGS AND FATIGUE LIFE FOR BALL BEARINGS

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FOREWORD

(This Foreword is not a part of American National Standard, Load Ratings and Fatigue Life for Ball Bearings.)

This revision of ANSI/AFBMA Standard 9 has as its principal features: 1) The use of an increased calculated stress at the center of the most heavily loaded rolling element/raceway contact which results in a total permanent deformation of 0.0001 of the rolling element diameter; and 2) the utilization of the factor f_{cm} which depends on the geometry of the bearing components, the accuracy to which the various components are made and contemporary, normally used material and its manufacturing quality.

This standard is in close conformity with ISO 76-1987 (Rolling bearings-Static load ratings) and with ISO DIS 281-1989 (Rolling bearings-Dynamic load ratings and rating life). Any significant differences, where they occur, are indicated in this standard.

The principal difference between this standard and ISO DIS 281 is the use of the f_{cm} factor which combines the f_c and b_m factors used in ISO 281. Dynamic load ratings calculated for the same bearing should have the same value, however, when following either this or the ISO Standard unless noted otherwise in this standard.

The life adjustment factor for special bearing properties, a_2, intended for use with capacities calculated in accordance with previous revisions of this Standard may not be valid for use with the current capacities. The present f_{cm} values incorporate material and processing improvements which were previously adjusted by means of the a_2 factor.

Copies of ISO Standards concerning Rolling Contact Bearings (Ball and Roller Bearings) are available from the American National Standards Institute.

Suggestions for the improvement of this standard gained from its use will be welcomed. Such suggestions should be sent to the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y., 10018.

The officers of Accredited Standards Committee B3 operating under American National Standards Institute procedures and the organizations represented at the time this standard was submitted are as follows:

S.R. Ahlman, Chairman G.T. Satterfield, Secretary

Anti-Friction Bearing Manufacturers Association
Hydraulic Institute
National Machine Tool Builders Association
Society of Tribologists and Lubrication Engineers
U.S. Department of the Navy
U.S. Department of Defense, DISC

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AFBMA Standards for Ball and Roller Bearings and Balls

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4 —Tolerance Definitions and Gaging Practices
7 —Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plans
8.1 —Ball and Roller Bearing Mounting Accessories, Metric Design
8.2 —Ball and Roller Bearing Mounting Accessories, Inch Design
9 —Load Ratings and Fatigue Life for Ball Bearings
10 —Metal Balls
11 —Load Ratings and Fatigue Life for Roller Bearings
12.1 —Instrument Ball Bearings, Metric Design
12.2 —Instrument Ball Bearings, Inch Design
13 —Rolling Bearing Vibration and Noise
14 —Housing for Bearings With Spherical Outside Surfaces
15 —Ball Bearings With Spherical Outside Surfaces and Extended Inner Ring Width (Includes Eccentric Locking Collars)
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24.2 —Thrust Bearings of Ball and Cylindrical Roller Types, Inch Design

An AFBMA Standard is intended as a guide to aid the manufacturer, the consumer and the general public. The existence of an AFBMA Standard does not in any respect preclude anyone, whether he has approved the Standard or not from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. AFBMA Standards are subject to revision or withdrawal at any time and users who refer to an AFBMA Standard should satisfy themselves that they have the latest information from the Association.

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Load Ratings and Fatigue Life For Ball Bearings

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Load Ratings and Fatigue Life For Ball Bearings

1. INTRODUCTION

1.1 Purpose of Standard

Ball bearing performance is a function of many variables. These include the bearing design, the characteristics of the material from which the bearings are made, the way in which they are manufactured, as well as many variables associated with their application. The only sure way to establish the satisfactory operation of a bearing selected for a specific application is by actual performance in the application. As this is often impractical, another basis is required to estimate the suitability of a particular bearing for a given application. This is the purpose of this standard.

This standard specifies the method of calculating the basic dynamic load rating of rolling bearings within the size ranges shown in the relevant ANSI/AFBMA standards, manufactured from contemporary, commonly used, good quality hardened steel in accordance with good manufacturing practice and basically of conventional design as regards the shape of rolling contact surfaces.

This standard also specifies the method of calculating the basic rating life, which is the life associated with 90% reliability, with commonly used material and manufacturing quality, and with conventional operating conditions. In addition, it specifies the method of calculating adjusted rating life, in which various reliabilities, special bearing properties and specific operating conditions are taken into account by means of life adjustment factors.

Furthermore, this standard specifies the method of calculating the basic static load rating and the static equivalent load for ball bearings within the size ranges shown in the relevant ANSI/AFBMA Standards, manufactured from good quality hardened steel, in accordance with good manufacturing practice and basically of conventional design as regards the shape of rolling contact surfaces.

1.2 Life Criterion

Even if ball bearings are properly mounted, adequately lubricated, protected from foreign matter, and are not subjected to extreme operating conditions, they can ultimately fatigue. Under ideal conditions, the repeated stresses developed in the contact areas between the ball and the raceways eventually can result in fatigue of the material which manifests itself as spalling of the load carrying surfaces. In most applications the fatigue life is the maximum useful life of a bearing. This fatigue is the criterion of life used as the basis for the first part of this standard.

Fatigue life calculated in accordance with this standard does not represent the maximum that can be attained by applying all known technology to ball bearing design and application. Neither does it represent the minimum that should be expected of a bearing made by a producer lacking skill and experience in the design and manufacture of ball bearings, even though the bearing meets the geometric parameters given below. The calculated fatigue life represents the performance normally expected from high quality bearings made by reputable manufacturers. Manufacturers can supply longer lived bearings by the application of advanced materials and manufacturing processes. The present standard has evolved as a means for bearing users to specify a reasonable standard of performance for the bearing they wish to purchase.

1.3 Static Load Criterion

A static load is a load acting on a non-rotating bearing. Permanent deformations